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AUTHOR	Marty, Paul; Sheahan, Kim; Lacy, Ann
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ABSTRACT

This paper presents preliminary results from a five year longitudinal study on the efficacy of integrating museum resources into elementary and middle school curricula through educational outreach activities, over the Internet and in the classroom. From 1997 to 2003, museum educators at the University of Illinois' Spurlock Museum have explored how students unable to travel to the museum could make the most effective use of the museum's online resources. Using problem-based learning methodologies, museum educators worked with several local school teachers to develop a series of projects that were closely integrated with the students' classroom activities. This paper evaluates the results of the program and presents the process of developing one of these projects: an analysis of the authenticity of ancient Egyptian cartonnage fragments. Three appendixes include: a donor letter (redacted), a sample page from a research packet, and an exhibit label copy. (Contains 10 references.) (Author)

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Evaluating The Authenticity Of Egyptian Cartonnage Fragments: Educational Outreach In Search Of The Truth

Paul Marty, School of Information Studies, Florida State University, Kim Sheahan, and Ann Lacy, Spurlock Museum, University of Illinois at Urbana-Champaign, USA

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Abstract

This paper presents preliminary results from a five year longiludinal study on the efficacy of integrating museum resources into elementary and middle school curricula through educational outreach activities, over the Internet and in the classroom. From 1997 to 2003, museum educators at the University of Illinois' Spurlock Museum have explored how students unable to travel to the museum could make the most effective use of the museum's online resources. Using problem-based learning methodologies, museum educators worked with several local school teachers to develop a series of projects that were closely integrated with the students' classroom activities. This paper evaluates the results of the program and presents the process of developing one of these projects: an analysis of the authenticity of ancient Egyptian cartonnage fragments.

Keywords: evaluation, museum education, middle school, authenticity, forgery

Introduction

This paper discusses the lessons learned from a museum/school educational outreach activity conducted over the past five years at the Spurlock Museum at the University of Illinois. From December 1997 to January 2003, over 300 students in ten different classrooms at seven different schools in Central Illinois have been engaged in an exploration of ancient Egyptian history enhanced by the addition of virtual and physical museum resources. Presented with alleged fragments of Egyptian cartonnage (waste papyrus or linen soaked in plaster, often used to create mummy casings), students— working in teams—were asked to assume the roles of museum curators and research the culture, beliefs, and practices of the ancient Egyptians to determine the authenticity of their artifacts. To facilitate the research process, students had access to online resources specifically developed by museum staff members for this project. The availability of these virtual resources, combined with the presence of the physical artifacts, successfully created an enhanced learning experience for the students.

This paper presents the preliminary findings of this study and documents the methods developed by the museum staff to work with the students. It discusses such issues as the relative benefits of sing physical museum artifacts, the importance of visiting the students' classrooms in person, the difficulties of communicating with students through email and online discussion boards, and the significance of developing online databases and electronic resource guides specially geared for the project. It is our hope that the results of this study will shed new light on how museum educators can work with elementary and middle school teachers to integrate museum resources into their curricula in the classroom and over the Internet.

Background and Significance of Project

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In November of 1997, a sixth-grade teacher from a local middle school approached staff members at the Spurlock Museum to see if they would be willing to collaborate on designing a problem-based learning experience (Boud & Feletti, 1991) for her students, who were going to be studying ancient Egypt in December. She wanted her students to assume the roles of museum curators, and then to deal with a real-life problem: the authenticity of one of their Egyptian artifacts is being challenged. Their tasks would be to research the artifact, investigate its authenticity, and determine its provenance, while paying particular attention to repatriation issues (such as the UNESCO 1971 treaty). She wondered if the museum could help her out.

In 1997, the Spurlock Museum had just begun a massive project to inventory, pack, and move its collections of 45,000 artifacts across campus to a new facility (Marty, 2000). As part of this move, the museum was to be closed to the public for over two years, and it was important to the museum staff that they find alternate methods of keeping the museum an active part of the local educational community. A project such as this one seemed like the perfect opportunity to explore the museum's potential role as something more than a field trip destination for area school children. In December 1997, therefore, museum staff worked with this sixth-grade teacher to design a prototype version of what would eventually become known as "Museum Problems in Today's World: Egyptian Mummification." The project was a success, and museum staff members soon worked to revise the program, making it more consistent and less focused on problem-based learning, so that it could be opened to more teachers and more widely distributed among area schools. From December 1997 to January 2003, this program has been run ten times at seven different schools and has reached over 300 elementary and middle school students in central Illinois.

When the program began, it was decided that the most appropriate artifact for the exercise would be a piece of ancient Egyptian cartonnage: waste papyrus or linen, soaked in plaster (similar to papier-mâché). Although the museum had several such pieces in its collection, it would have been inappropriate for the museum to send these artifacts to the schools. Each time the "cartonnage project" is run, therefore, reproductions of ancient Egyptian cartonnage fragments—manufactured by museum staff members—are delivered to the schools (see Figure 1).

Figure 1: Sample Cartonnage Fragments

In addition to these physical artifacts, students are provided with access to the museum's online database systems so that they can access database records for similar pieces, a resource guide to ancient Egyptian mummification specifically created by museum staff members for this project (http://www.spurlock.uiuc.edu/education/resources/mummification), and a series of research documents written by the museum's educators designed to provide guidance for the students as they research the cartonnage fragment. The students also have access to materials in their own school and local libraries and on the open Internet. The students generally work in teams of four or five, usually dividing up tasks so that each student could research a different aspect of the artifacts. Depending on the teachers' schedule, the students have (on average) two to three weeks to use these resources to prepare their findings on the artifacts. At the end of this time, the students make a presentation to a panel of museum staff members, where they announce their findings and make their recommendations.

The cartonnage project has been a great success for museum staff, teachers, and students alike. Museum staff members find it an effective way of keeping the Spurlock Museum an active part of the educational community (even when the museum was closed to the public). It provides new opportunities for museum-school interactions, both in the classroom and online. Teachers use the cartonnage project to introduce their units on Ancient Egypt. One of the more popular times to run the program is between Thanksgiving and Winter break, as the highly interactive nature of the project keeps students involved at a time when it is often difficult to keep students interested in school. The students find it an exciting and involving way of exploring ancient Egypt. They feel that they have a personal stake in the project, and some students—months after the completion of the project—have even contacted the museum's educators to ask them whether they have implemented the students' recommendations.

That this project should have been successful is perhaps not surprising. Educational outreach projects connecting museums and schools have received a great deal of attention over the past few years, much of it at the Museums and the Web conference. Faculty from Museum Studies departments as well as museum curators have discussed the pedagogical impact of virtual museums from both educational and museological perspectives (Teather & Wilhelm, 1999; Sumption, 2001). Researchers at the University of Michigan have explored the challenges of coordinating teachers, museum professionals, and information specialists to create online exhibitions (Frost, 1999; Frost, 2001). Researchers at the University of Illinois have explored methods of integrating digital primary source materials from cultural heritage museums into classrooms (Bennet & Trofanenko, 2002; Bennet & Sandore, 2001). Museum educators at the Seattle Art Museum have even used the Internet to help sixth-grade students in Seattle better understand the curatorial process (Adams, et al., 2001). What is there that makes the project at the Spurlock Museum unique?

We feel that the cartonnage project is important for two reasons. First, the project has evolved (and is still evolving) over a period of five years. There is a tremendous amount of longitudinal data available that document what we learned during this time about what worked and why. We can use these data to examine how this project changed over time in response to the reactions, interactions, and levels of involvement of students, teachers, and museum personnel. We can discuss how changes to this project over time affected the students' ability to learn, what they learned, and how they worked within the program. This analysis can help us determine what drove the historical evolution of the project and how changes in the relationships between students, teachers, and museum professionals affect the development of educational outreach projects.

Second, preliminary data analysis of this project revealed an extremely interesting fact: of the 300 students involved in this project, approximately 75% reached the conclusion that the artifacts were authentic. Of the other 25%, the majority were undecided; of those students who did believe they were fake, most decided the fragments were 19th century reproductions. Not a single student ever suggested

that the museum fabricated these artifacts for the purposes of this project. If the museum staff had been trying to create a perfect, flawless cartonnage fragment reproduction, then these numbers might be understandable; indeed, they would testify to the skill of the museum staff members involved. The museum staff, however, had created artifacts specifically designed to be identified as forgeries; clearly visible are several prominently placed clues to the artifacts' lack of authenticity (see below). Amazingly, the students' tendency to find the artifacts authentic was not because they did not find these clues. On the contrary, the students seemed to have an inherent reluctance to pronounce the artifacts fake; they went to tremendous lengths to ignore and/or explain away these clues when they were discovered. This paper will attempt to determine why this occurred.

Methods and Limitations of Study

This is a discussion of preliminary research findings drawn from observations made by museum staff members as they worked with students over the past five years. This is not a formal study with rigorous data collection procedures. When this program began, it was not the intention of the museum staff members to conduct a formal research project. Although extensive data were gathered from the students each time the program was run, identical data collection instruments were not used in each instance.

A significant amount of data, however, is available. The majority of the panel presentations were videotaped, as well as many of the regular classroom sessions where the students interacted with the artifacts and researched ancient Egyptian mummification. The creation of the cartonnage fragment reproduction was carefully documented. Extensive notes were taken throughout the project, by museum staff members as well as teachers. The various versions of the online documents, resource guides, and database records are all well documented. One implementation of the project (which took place during Fall 2000) was thoroughly documented and described by a doctoral student from the College of Education at the University of Illinois as part of a research study into museum outreach programs in public elementary schools (Costantino, 2001).

There are, naturally, limitations to these data. The fact that this project has been conducted at different schools, using different approaches, with different students who have different reactions, with non-standard data collection procedures, means that it is not possible to do a comparative study of why a group of students at one school in one year reached different conclusions from a second group of students at a different school in a different year. The available data, however, have allowed us to conduct our present analysis of a) the history of the cartonnage project as the museum staff evolved and adapted the program over time, and b) the interactions between students, teachers, and museum professionals, and the development of those interactions over time. It is our hope that this analysis will be of use to educators and museum professionals interested in educational outreach projects from museums to schools.

We begin our analysis with a discussion of the evolution of this project over the years from 1997 to 2003. This evolution was an organic, natural process whereby the museum's procedures in implementing the cartonnage project changed as we worked with the teachers and students, adapting each implementation to better suit the needs of the educational community the museum serves.

Historical Evolution (1997 to 2003)

Museum staff members working with the cartonnage project quickly found that they needed to be flexible; they could not present exactly the same project each time the program was run. They had to adapt to new and unpredictable situations, which in turn led to new adaptations and a constantly evolving educational outreach program. This section presents an overview of the primary evolutionary stages of this project, discussing the changes made over time, the rationale behind those changes, and what was learned from making those changes.

As mentioned above, this program has been run ten times at seven different schools since its inception; over 300 students in central Illinois have researched the authenticity of Egyptian cartonnage fragment reproductions. All but one of these programs was run with sixth grade students (the other was implemented with a group of gifted students from grades three through five). Not including the initial prototype version run in December 1997, there have been three distinct versions of this project; the third version is the one that museum staff members are currently implementing in local schools. This section of the paper includes descriptions of each version of the project, and discusses how each version evolved over time in response to the needs of students, teachers, and museum staff members (see Table 1 for a summary of this evolution).

Prototype Version (1997)

In December 1997, museum staff members, working with the sixth-grade teacher whose idea began the project, decided that the most appropriate artifact for this exercise would be a piece of ancient Egyptian cartonnage. Since no actual artifact could be taken to the schools, museum staff members decided to provide online access to the museum's database records for a dozen actual pieces of cartonnage in the Spurlock Museum's collections. The teacher, who still wanted a physical artifact, decided to manufacture a fake piece of cartonnage herself. She took a six-inch square piece of linen, soaked it in plaster, painted it with Egyptian hieroglyphics, and -in an attempt to age it—buried it in her back yard (when delivered to the class, it still had a fresh pine needle stuck in it).

With this prototype version, the vast majority of the work was accomplished by the teacher herself. She developed all the documentation necessary to guide her students' research in problem-based learning. She gathered all the resources her students would need to examine the artifact and determine its authenticity. She incorporated all of this into her ongoing unit on ancient Egypt. Museum staff members made themselves available for email questions, and served at the end of the project on a panel so that the sixth grade students could present the findings of their research. Aside from this, however, the museum played no direct role in managing the prototype version of the project.

Version 1 (1998-1999)

One year later, this same sixth-grade teacher, along with an additional teacher from a different school, approached museum staff members to see if they could do this project again. This time, museum staff members were able to dedicate a significant amount of time to improving the project; the result was the first full-featured version of the cartonnage project. The major changes from the Prototype to Version 1 were an improved version of the cartonnage fragment, an entirely new online interface, and a larger role for the museum in the presentation of the problem.

The museum's Collections Manager and her assistant took on the task of creating a new, improved version of the cartonnage reproduction (cf. Figure 1). It took over twenty hours of work for them to design and create a replica mummy pectoral piece using plaster-soaked linen; the pectoral was painted to resemble an Egyptian artifact. To clearly identify this piece as a forgery, they purposely planted several clues on the artifact: spots of hot pink and hot green paint, several non-Egyptian hieroglyphs, and a Mayan figure in full regalia. Once the artifact was complete, it then took another twenty hours of work to destroy the artifact and age it two thousand years. The artifact was divided into six pieces, and two sets of three pieces each were mounted in glass display frames. By creating two sets of fragments, museum staff members made it possible for the program to be run at two different schools at the same time. They ensured that each set included sufficient clues, including half of the Mayan figure. The small, left-over pieces of cartonnage that broke off during the aging process were placed into plastic bags so that students could analyze these fragments in detail.

The museum staff also made major changes to the online interface. Realizing that simple access to database records was not sufficient information for the students,

museum staff members created an elaborate, fictional database access system called the "Spurlock Museum Management System." This "system" was simply a series of password-protected ~~eb~~-Web pages which gave the illusion of providing access to detailed information about museum operating procedures. The password provided to the students gave them access to two things: a series of documents about museum careers (including job descriptions and required education levels for each job) and a "main project page" for researching the cartonnage fragments. This project page provided links to four types of resources: a set of research notes, a list of database records, a glossary of terms, and a *WebBoard*. The research notes were a series of lengthy pages about Egyptian mummification practices, linked to multiple pages covering more detailed topics, with a navigation system that challenged students to read the text carefully when searching for answers. The list of database records was an expanded list of relevant Egyptian artifacts from the museum's collections. The *WebBoard* provided a simple discussion board interface where students could post questions and museum educators could post responses.

Spurlock Museum staff members assumed a new, major role in the presentation of the project to the students, making substantial modifications to how the "problem" was described. In this version, students were told that the museum had received a set of Egyptian cartonnage fragments from the registrar at the Sherman County Historical Society. Since this historical society only collected local heritage materials, the registrar wondered if the Spurlock Museum would be interested in accessioning the artifacts, which had been found in an unmarked box in their storeroom. The students were asked to help the museum staff research the artifacts' provenance and determine their authenticity. This setup was, of course, completely fictitious; there is no "Sherman County Historical Society." Spurlock Museum educators created a letter from the fictitious donor (see Appendix 1) who supposedly gave the artifacts to the historical society and a letter from the Spurlock Museum's director, thanking the students for their help in this research project. Museum staff members also created an accession card for the artifacts, listing the information supposedly recorded by the historical society. The letter from the donor was specifically written to address the UNESCO treaty issue, and provided evidence that the artifacts entered the United States before 1966. Copies of these documents were delivered to the students participating in the program.

Museum staff members also assumed a major role in delivering the artifacts to the students. The cartonnage fragments arrived with a lot of "pomp and circumstance," carried in by the museum's Collections Manager and her assistant wearing white lab coats and using gloves. The museum educators even considered having a security guard accompany the artifacts in full uniform, but decided against it.

Version 2 (2000-2001)

Early in the year 2000, museum staff members decided that they needed to make additional revisions in the cartonnage project. Although the physical artifacts were a great success, the online resources were being insufficiently used and needed to be improved. Moreover, museum educators were unsatisfied with the presentation of the problem to the students, as the fictitious setup was making it difficult to run the same project for a second year in the same school. Attempts to resolve these issues resulted in Version 2 of the cartonnage project.

For Version 2, the online resources available to the students were completely revised. The fictional "Spurlock Museum Management System" was dismantled and replaced with a simple Web page that linked to three resources. The first link was to a resource guide about Egyptian Mummification (http://www.spurlock.uiuc.edu/education/resources/mummification). The second link was to a series of documents about the research process (http://www.spurlock.uiuc.edu/education/resources). The third link was to the same *WebBoard* from Version 1 (no changes were made to the *WebBoard* at this time).

The original version of the resource guide had proved so difficult to navigate that it was unusable by most of the students. The online resource guide for Version 2 was completely reorganized, with a new graphical interface that included illustrations and embedded links for further information about relevant artifacts in the museum's collections. The guide was organized into seven categories: history, rituals, artifacts, sources, materials, chronology, and glossary (see Figure 2 for a sample screen shot). An external graphic designer was hired by the museum to develop the site's look and feel, and construct icons and other images.

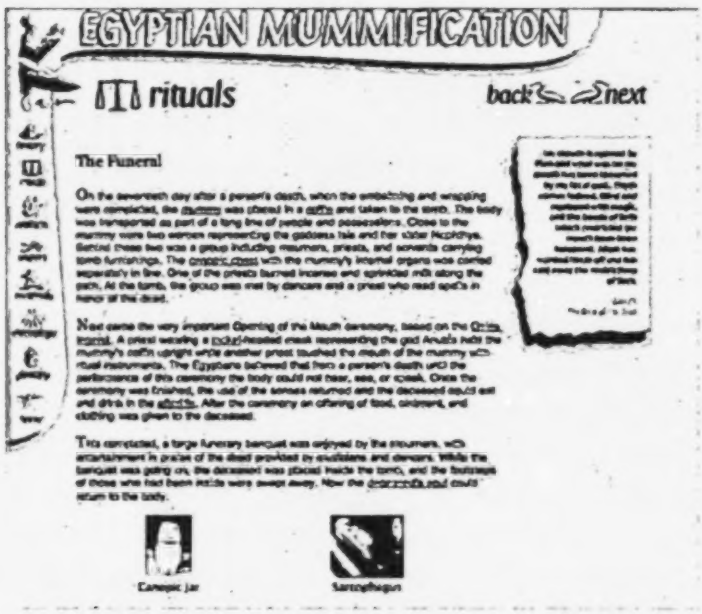

Figure 2: Sample Screen from Online Resource Guide

In addition, museum educators wrote a series of documents about the research process (including information on identifying reliable sources and distinguishing fakes from forgeries); these documents were placed online in Adobe Acrobat format. These additional resources were specifically requested by the teachers, who wanted to provide their students with more accurate information about how to conduct research and how to identify fakes and forgeries. In writing these documents, museum educators took advantage of this request to remedy existing problems with the program. One document, for example, helped the students refocus their research efforts (which often strayed from the artifacts) by teaching them how to observe the artifacts more carefully. A second document addressed the common student belief that if something looked real, then it was; this document explained how forgers were skilled at making things look real, even if they were not. Finally, to help the students understand the research process even better, museum educators developed a "research packet," which helped the students formulate their research questions, record their findings, and document their sources (see Appendix 2).

With the new online resources available, museum educators attempted to sort out the difficulties behind presenting a fictitious problem to a class of students. What resulted was a mishmash of techniques, where over the next several implementations of the program museum staff presented the problem in slightly different ways. They still claimed that the object was from another museum, but presented it as an educational program specifically designed to allow school children to work with museum professionals on real life projects. Other than the letter from the donor, no additional documents were given to the students. Within the donor letter itself, any references to the name of the artifacts' original owner or the name of the "Sherman County Historical Society" were blacked out. The

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students were told that the letter was censored to protect the privacy of the donor; in reality, the censoring helped museum educators avoid a growing problem where students kept trying to locate the "Sherman County Historical Society" in real life.

Version 3 (2002-2003)

By 2002, the museum educators—although still happy with the physical artifacts and online resources—continued to have difficulties with the presentation of the problem to the students. Since this project was now run every year, often at the same school, museum educators wondered if the students would soon stop believing that the museum still needed their help researching the same artifact. To resolve this dilemma, museum staff members decided to return to the original idea of the sixth-grade teacher who initiated the project in 1997.

Version 3, the current version of the project, presents the situation as a problem that happens to curators all the time. Museum staff members tell the students that while the cartonnage fragments were on display in their museum, a stranger claimed that the label copy describing the artifacts was erroneous. The students are then told that this stranger left immediately and that the museum had no way of determining his identity or asking him any follow-up questions. The students are then asked to help the museum staff members confirm the contents of the label copy (see Appendix 3). By presenting the problem in this way, the museum educators have found it much easier to deal with direct questions from the students with much less fabrication. If the students ask the direct question "are you telling us the truth?" the museum educators now reply that the setup (that a stranger commented on these artifacts) is not true, but that these are actual museum artifacts and that this is an actual problem which curators deal with on a regular basis.

Finally, two minor changes were made to the online resources during the transition from Version 2 to Version 3. First, museum staff members decided to get rid of the simple, introductory page linking to the online resources; all online materials are now accessible from the Programs and Events section of the main Spurlock Museum Web site (http://www.spurlock.uiuc.edu/education). Second, museum staff members decided to no longer use the *WebBoard* for communication with the students. Although this may seem like a major change to the online interface, the *WebBoard* discussions were quite easily replaced by email (see below for further discussion).

This discussion has therefore summarized the evolution of the different versions of the cartonnage project. One implementation was run using the prototype version. Three implementations were run using Version 1. Four implementations were run using Version 2. Two implementations were run using Version 3. At least two more implementations using this version are scheduled for the spring semester of 2003.

	Dates	Artifacts Made by	Documentation	Online Resources	Communication
Prototype	1997	Teacher	No formal documents	Stand alone database records	Email, and panel presentations
Version 1	1998-1999	Museum	Accession card, letter from fictitious donor, and letter from museum director	Fictional museum management system with integrated database records and early version of resource guide	Staff visits, email, webboard, and panel presentations

Version 2	2000-2001	Museum	Letter from fictitious donor (censored)	Complete resource guide with integrated database records as well as research documents	Staff visits, email, webboard, and panel presentations
Version 3	2002-2003	Museum	Letter from fictitious donor (censored); exhibit label copy	Complete resource guide with integrated database records as well as research documents	Staff visits, email, and panel presentations

Table 1: Summary of Evolution of Versions

Analysis of Student Activities and Interactions

This section presents an analysis of the students' activities and interactions as they worked with the artifacts, the available resources (both physical and online), their teachers, the museum personnel, and each other. It discusses the overall trends we observed in terms of how the students participated with the museum personnel on the project, what their levels of involvement and understanding of the project were, and how these things changed over time. In doing so, we will attempt to determine what the students learned from participating in this project.

There will be four different types of activities and interactions discussed. First, we will look at how the students interacted with the artifacts. Second, we will explore how the students made use of the information resources, both physical and virtual, at their disposal. Third, we will examine the different approaches to research taken by the students. Finally, we will discuss the students' learning processes, focusing on how their levels of understanding changed over time.

Interactions with Artifacts

How did the students interact with the artifacts? The artifacts were generally brought to the school and presented to the students fairly early in the project; the students would usually have had some initial introduction to ancient Egypt, have been told about the upcoming project, and have been looking forward to the arrival of the actual artifacts themselves. The artifacts were brought to the school by museum staff members who clearly treated the artifacts with a great deal of respect. The teachers were required to sign an official "loan form," further impressing upon the students the value of these artifacts. The students were taught proper artifact handling procedures which stressed the importance of handling the artifacts carefully, with gloves, and treating the artifacts with respect at all times. The students were not allowed to handle the main pieces of cartonnage; these were kept intact in a glass display frame. The students were allowed to handle several small pieces of cartonnage, but only with tweezers. The seriousness of these procedures had a big impact on the students. They were very careful to always wear gloves when handling the artifacts; they treated the artifacts with respect, as they had been trained to do. During the panel presentations, if some students forgot to wear gloves, other students would even remind them to do so. The extent of their training in artifact handling likely was a major factor in the students' persistent belief that the artifacts were authentic; if the artifacts were not authentic, some students asked us, why would we be so strict about artifact handling procedures? The students never asked why, however, if the artifacts were authentic, museum staff members would have let them out of

the museum.

What did the students do while studying the artifacts? As will be discussed in more detail below, students took a common approach to studying the artifacts, examining the hieroglyphics, colors, gods, and material composition of the pieces. They tried to identify the gods, decipher the hieroglyphics, and determine whether or not the colors on the cartonnage fragments matched known pigments available to the ancient Egyptians. Since students were unable to remove the cartonnage fragments from the display cases, they had to rely on the fragments provided in the plastic bags for material analysis. They typically examined these small fragments carefully to see what they were made of and determine their authenticity and, if possible, the age of the fragments. Only in a few cases did students attempt anything innovative; one group, for example, extrapolated from the fragments they were given a theoretical reproduction of what the entire pectoral piece might have looked like.

How much time did the students spend working directly with the artifacts? In most cases, students did not spend as much time working directly with the artifacts as the museum staff members expected they would. Their typical approach was to spend one day studying the cartonnage fragments at the beginning of the project, and then put the fragments aside and only occasionally look at them before the final panel presentation. The students spent enough time with the objects to answer questions about the appropriateness of the colors and attempt a translation of the hieroglyphics, but the artifacts themselves were rarely the focus of the classes' attention. After their initial study of the artifacts, the students typically turned their attention to the research process, searching the Internet and their school's library for information about cartonnage and the mummification process. Only recently have museum staff members made a point of stressing in class the value of constantly returning to the artifacts during the research process. While having the artifacts in the classroom throughout the project provided a catalyst for the students' research activities, the students did not understand the significance of making the artifacts a part of their research process until they were told to do so.

Use of Information Resources

How did the students make use of the online resources provided by the museum? Depending on computer availability, students were regular visitors to the museum's Web site and resource guide; almost every student referred to the museum's Web site in their panel presentations. It appears as if the fact that museum staff members provided them with an online resource guide to Egyptian Mummification had a significant impact on the students' approach to the project. The online resource guide helped them start the research process, and they searched the museum's Web site for clues as to the artifact's authenticity. Many students believed that the mere fact that the museum had provided this Web site proved that the artifacts were from ancient Egypt. Why else would we have given them that site? Students stopped asking this question when museum staff members decided to make these online resources available from the museum's public Web site along with resource pages on several other topics. Nevertheless, as the source of both the artifacts and a primary source of data about Egyptian mummification, the students usually accepted the authority of the museum without question.

What other resources did the students use? All students had access to a variety of information resources, including books, articles, and Web sites, accessible from their classroom, their school or public library, or their home. The students were frequent users of the open Internet; in the late 1990s, some students relied almost entirely on the Internet for the data. Every student used at least one Web site (other than the site provided by the museum) while conducting the research. Most often, these were sites on the use of color or hieroglyphics in ancient Egypt. Different classes almost always located completely different Web sites, which were passed from one group of students to another, and on which students often based the foundations of their arguments. In this way, Web sites with erroneous information frequently spread mistakes throughout an entire classroom of students

like some kind of knowledge virus. Students also used books (although only infrequently would students use their textbooks) in their research, often looking up translations of hieroglyphics or trying to identify the images on the fragments. Many students also found basic information on ancient Egypt and mummification from books; in one case, a group of students working on this project checked out almost every book on ancient Egypt from their local public library.

Approach to Research

What research questions did the students ask? On the first day of the project, students were encouraged to develop a list of questions they would like answered. More questions would generally be added to the list later on as they examined the artifacts and spent more time conducting research. The most commonly asked questions were: Who made this? When was it made? What was it made for? What is it made from? What time period is it from? Where is it from? What is shown in the pictures? What do the hieroglyphs say? What is the significance of the colors? Over the course of the project, however, the students usually became more and more focused on the overall question: Is this real?

What research methods did the students use to answer these questions? To ensure that the students started by looking at a source they could count on as reliable, museum staff members initiated the research process by providing the address of the Museum's online resource guide to Egyptian Mummification. Most often, students began the project by spending time either in a computer lab or on one or more computers in the classroom. The more available computers, the more likely students were to focus on online resources. Having fewer available computers quickly directed the students toward their library books. Museum staff members were available for questions over the Internet (via email or on the *WebBoard*). In addition, at least one museum staff member would visit the students for a question/answer session halfway through the project. To provide the students with a consistent source from the museum, the assistant director of education was established as the students' primary contact at the museum.

What approach did the students use to determine the authenticity of the cartonnage fragments? With few exceptions, students primarily focused on four factors: the hieroglyphics written on the fragments, the colors painted on the fragments, the materials the fragments were made from, and the gods depicted on the fragments. These factors, almost always in this order, comprised the four main arguments put forth by the students in the panel presentations. Based on their findings regarding the hieroglyphics, colors, material types, and the gods, the students would render a verdict of authentic or forgery in front of a panel of museum staff members.

What was the most frequent decision reached by the students researching the fragments? As discussed above, about three out of every four students decided that the artifacts were authentic; of these students, about half reached this conclusion based solely on their analysis of the colors found on the artifacts. Most students were absolutely convinced that these reproductions were real, and this belief was not limited to the reproduction made by the museum staff. When the prototype version was run, one student told us that he believed the museum staff had taken a piece of cartonnage from their collection and ripped a square piece out of it; he even showed us, on the online database, a piece of cartonnage that—by complete coincidence—was missing a piece exactly the right size and shape. The major obstacle the students faced throughout the project was their tendency to look for reasons to prove that these artifacts were real, and not to prove that they were fake. Even when faced with the clues planted by museum staff (such as the spot of hot pink paint), students tended to rationalize these clues away (arguing that perhaps red pigments, when two thousand years old, might look like hot pink).

Did any student ever discover the Mayan figure? From 1997 to 2003, the Mayan figure has only been discovered three times, and each time it was discarded and never brought up again. The first time this happened, the student who discovered it pointed out that this looked like a Mayan figure but decided that this was not a

problem since it was likely that Egyptian and Mayan cultures were aware of each other; she told us that she reached this conclusion because she had learned about Egyptian and Mayan civilizations from the same book. The second time the figure was discovered, it was identified by a learning disabled student who thought there was something odd about that figure, but could not decide exactly what it was; before he could explore it further, however, he was quickly shut down by his fellow group members. The third and final time the Mayan figure was discovered, a group of students thought the figure looked like an Aztec warrior; they explained away this apparent anomaly, however, by stating that since the Egyptians and the Aztecs both lived in the tropics, it was likely that the Egyptians also portrayed figures with leaves around their wrists and ankles, as the Mayan figure was depicted.

Learning Processes

How did the students' understanding of museum activities change over time? The students' understanding of what a museum curator does improved dramatically over the evolution of this project. In Version 1 of the program, the students had a very hard time understanding the role of the museum curator when working with artifacts. This was, in part, because the museum educators, in an attempt to provide a certain amount of intellectual rigor, orginally told the students that museums were expected to possess 100% accurate information, and that museum curators were responsible for ensuring the accuracy of the museum's information. Students were provided a list of "questions curators were supposed to be able to answer," including questions about the physical characteristics of the artifacts, the provenance of the artifacts, whether or not the artifacts complied with the 1971 UNESCO treaty, and the basis for information about the artifacts as provided by the donor. This list was supposed to help the students formulate their own research questions; instead it became a burden, forcing students to worry about treaties instead of the artifacts. To solve this problem, the museum educators adapted their approach in Version 2, asking the students to develop their own questions through small group discussions. Encouraging the students to think like detectives helped them become inspired by the job of the museum curator. The new presentation of the problem developed in Version 3 went even further, providing the students with an even more straightforward problem to solve: who do you think is right? The mysterious stranger? Or the donor? By drawing the students into the inquiry process, these changes helped the students better understand the job of the museum curator.

How did students' understanding of the research process change over time? The students' abilities to conduct research and understand research methods improved dramatically from 1997 to 2003. This was especially true in the case of the students' online searching skills, where they became much more aware of the need to assess the quality of information they found online. In December of 1997, one student actually believed (and stated) that everything she read on the computer had to be true. By the spring of 2002, however, students were comparing the overall reliability of sites from dot-edu or dot-com domains. This change is likely due in part to the efforts of both museum professionals and teachers to explain the importance of good research methods to the students. Throughout the development of this program, for instance, museum staff members have continued to provide more explicit documents about good research habits. Museum educators and teachers alike continued to stress the importance of having and citing a source for every piece of information. These efforts have consistently led to students with higher quality research skills.

How did the students' approach to logical arguments and critical thinking change over time? The students' abilities to think critically and make logical arguments did not change significantly over the course of this study. Students did not want to believe that the museum might bring them artifacts that were not real, and they would go to tremendous lengths to dismiss any evidence that might possibly imply a fake. When arguing that the artifacts were authentic, students twisted their logic in strange, clever, and often unexpected ways; students who thought the artifacts were fake, however, usually did not employ such logical contortions. For instance, when attempting to translate the hieroglyphics on the artifacts, students usually found several hieroglyphs they could not identify: the signs planted by the

museum staff as clues that the objects were fake (some of the "Egyptian hieroglyphs" were actually Mayan numbers). Instead of reaching that conclusion, however, students decided that these hieroglyphs must either be signs that had not yet been discovered or signs that were too rare to be listed in the books in their school library ("we're only sixth graders, after all," one group told us). The possibility that these signs might not be Egyptian hieroglyphs at all never occurred to them. For another example, when attempting to use the colors found on the artifacts to determine their authenticity, the students almost always began with a list of colors the ancient Egyptians could produce and then looked to see if those colors were found on the artifacts. They almost never checked the reverse, looking to see if any colors found on the artifacts could not have been made in ancient Egypt. In ways such as these, the students would skew their answers to match their expectations.

Analysis of the Museum/School Relationship

This section presents an analysis of what we learned about supporting a cooperative relationship between museums and schools when conducting educational outreach programs. It discusses what we learned as we moved from version to version, evolving the program to create a better product. In doing so, we hope to summarize the most important lessons we learned about what makes for a successful relationship between museum educators and school teachers.

We will examine three different areas of this relationship. First, we will look at levels of involvement in the classroom, from the perspectives of both teacher and museum educator. Second, we will examine the issue of availability of online resources and the importance of access to technology. Finally, we will discuss the relevance of this program to the curricular needs of the school and its impact on the success of the project.

Levels of Involvement in Classroom

How involved were museum staff members in classroom activities? The success of this program was directly related to the amount of time museum staff members were able to dedicate to the classes researching the cartonnage fragments. From the onset of Version 1, Spurlock Museum educators and other staff members remained very involved in the classroom: they made several trips to each class, at the beginning, middle, and end of the project; they were constantly available to answer questions for the students, either by email or using the *WebBoard*. Any museum educator planning to initiate a project such as this one must be aware of the need to dedicate a great deal of time to helping the students have a successful experience. In addition, when collaborating with teachers who were not so familiar with active learning or problem-based learning techniques, the museum educators found that they had to spend more time in the classroom and play more significant roles in setting up the project and assisting the students.

How involved were the teachers in classroom activities? The success of the program was directly related to the amount of time the teachers were able to spend with their students on this project. The more involved the teachers were, the more confident they were in their research skills, and the greater their knowledge of the content area, the more the students got out of the project—in terms of Egyptian history, museum practices, and research activities. Likewise, the more time the teacher spent researching ancient Egypt ahead of time, finding appropriate resources and checking books out of the library in advance, the greater the impact of the project on the students. Students who were able to spend three weeks on the project generally learned more than students who only had two weeks; this was especially true with schools taking a problem-based learning approach (which took longer to set up). Few schools, however, could afford to dedicate three entire weeks to this project. Nevertheless, even teachers who could spend only one week on this project found it instrumental in changing the perception of the museum from a once-a-year field trip destination to a valuable resource that could be directly integrated into the classroom curriculum. With the students relying heavily on the Internet for their information, however, teachers had to be prepared to vet for inappropriate material all sites discovered

by the students.

Availability of Online Resources

How did access to the online resources provided by the museum affect the students' successful completion of the project? Students working with the cartonnage fragments had access to museum-provided information about Egyptian mummification practices (including information specifically about cartonnage) as well as museum practices and research methods. When students did not have access to this information, as in the prototype version when only an online list of database records was provided, students gathered most of their information from other online sources. As the museum made more information available online, and as artifact database records were integrated into the online resource guide, the students began to rely on the museum-provided Web site as their primary source of information. Students were not particularly interested in the elaborate, fictional "Spurlock Museum Management System" provided in Version 1; they preferred the straightforward access to information about mummification and research activities available in Version 2. Students, however, were much more likely to make use of the resource guide on Egyptian mummification than they were to read the documents written by the museum educators about conducting research and determining the authenticity of an artifact. It is possible that this indicates a preference for information provided in a graphical format over text-only documents. It is also possible that this reflects the students' (or teachers') unfamiliarity with Adobe Acrobat; to account for this possibility, the museum educators have recently begun taking hard copies of the research documents with them on their classroom visits.

How did access to the necessary technology affect the program? Although successful completion of the project assumed that the students would have access to the Internet in order to read the online resources provided by the museum, this was not explicitly a requirement of the program. Several schools had to cope with technological failures that resulted in students having little or no time in the computer lab. Students who were unable to access the museum's online resources had to rely on their school libraries for information. When the museum was working with students who had access to the Internet in their classroom, the museum staff found that the students were more likely to have a thorough understanding of what the museum wanted them to do (especially when working computers were available throughout the project). These students, however, were also more likely to have found less reliable sources of information by concentrating their search on the open Internet.

What was the impact of using the *WebBoard* for communication between students and museum educators? With the implementation of Version 1, museum staff members had very high hopes for the museum-school interactions made possible by the *WebBoard*. At the end of Version 2, however, the museum staff decided no longer to use the *WebBoard* technology. This was for several reasons. First, Spurlock staff members were not running the *WebBoard* from their own server, and therefore were paying expensive licensing fees each time the program was run. Second, the *WebBoard* discussions often turned out to be unhelpful and sometimes harmful to the project. Students wasted a great deal of time making off topic or inappropriate posts. They would usually ask the same questions over and over, wasting the museum educators' time. They would post useless requests such as, "Please tell us whether this is authentic. Thank you." Some students would even post threats, demanding that museum staff members tell them the answers "or else." In the end, it was simply easier for the museum to drop the *WebBoard* component and rely solely on email for asynchronous interactions between students and museum employees. To reduce the number of inappropriate or repetitious questions, the teacher now collects the students' questions, are now collected by the teacher, who edits them, and sends a moderated list to the museum educators. This illustrates the advantage of having greater teacher involvement in online communication between schools and museums.

Relevance to Curriculum

How did this lesson relate to classroom projects as part of a course on ancient Egypt? One of the biggest factors behind the success of this project was that it is most often used to introduce a unit on ancient Egypt. Providing the students with a hands-on, active learning experience made the concept of studying Egypt more exciting. Having a practical introduction such as the cartonnage project made the students look forward to learning more about Egypt in the traditional classroom setting.

What was the value of the panel presentations to the project? The fact that the students were required to do group presentations to a panel of museum staff members at the end of each project had a serious impact on the students' behavior. Knowing that the museum staff would be "evaluating their work" made them take the project very seriously. In addition, the panel discussion format let the students know that the museum took their work seriously as well. The museum educators explained to the students that no one expected them to provide all the answers to every question. Nevertheless, the fact that the museum employees actually listened to the students and took their advice to heart clearly impressed the students and made them feel that their work was truly important.

Is this project beyond the capabilities of elementary or middle school students? Over the years, the museum staff has adjusted and adapted the program to reduce the number of potential pitfalls that could trip up the students. Most recently, museum educators dropped the discussion of UNESCO treaty issues simply because it was too hard for most sixth grade students to understand. The one time that the museum tried running this project with elementary school students (gifted students from grades three to five), the students had trouble understanding the purpose of research; they were also plagued by technological problems which limited their time on the computers. Even at that young age, however, and despite challenges of time and technology, the project successfully motivated the students and piqued their interest in both ancient Egypt and research methods. For middle school students, the program, at least in its current form, seems to be at an appropriate level for an introductory project to ancient Egypt, the museum profession, and the practice of conducting research.

Conclusions

The evolution of the cartonnage project from the prototype version in 1997 to the current version in 2003 was extremely time-consuming for the staff of the Spurlock Museum, requiring a great deal of analysis and revision. They worked toward a program that would be easy for teachers to manage and not too hard for students to understand. They worked to help students avoid pitfalls and come to the right conclusions. Their most difficult challenge, however, was getting the students to accept the project on their own terms and at face value.

It was only recently that students were willing to accept the project as a simulation, to approach it as a learning experience. In doing so, the students were freed to understand the true goal of the exercise: to appreciate the purpose of research. They were no longer looking for the right answer to fill in a blank on a test; rather they were coming to their own conclusions. They understood that there was no trick question, that the right answer was the answer they uncovered as researchers, that they themselves were the source of the answers. Moreover, they understood that the answer itself is not as important as the process of inquiry: asking questions, conducting research, and supporting their findings with sources.

The amount of time required to reach this goal demonstrates the difficulty of creating a program such as this; museum staff members needed to keep evolving, improving, and constantly working to meet the needs of students and teachers. Museum educators had to wrestle with difficult questions. In using fictitious documents, did they risk their own credibility while emphasizing the importance of credible and reliable sources? Did they have an obligation to let the students know eventually that these artifacts were in fact reproductions? One group of students did track the museum educators down, months after the end of their project, demanding to know the answer...and they were told. But those students were the only ones that ever reacted in that way, the only group that was overly bothered

by the fact that museum educators were perhaps not telling them the whole story. And this, for the museum staff, best illustrates the success of the cartonnage project. When students see that they themselves are the source of the answers, that there is no right or wrong, that there is only a process of discovery, students learn the only real truth.

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Appendix A: Donor Letter (redacted)

[redacted]

[redacted]

June 21, 1966

Dear [redacted]

Thank you for taking the time to talk to me on the telephone yesterday. I hope the Egyptian objects I am sending you will be of use to the [redacted]

You asked me to give you all the information I have on these objects for your records. It isn't very much, I'm afraid. They are an inheritance from my great-uncle, who lived in Scotland, and my only contact with him took place many years ago. In truth, I am very surprised and pleased to find he had remembered my childhood fascination with his collections after so many years. Here is what I remember of what he told me:

1) The objects were purchased by my great-uncle, [redacted] in Egypt during the 1870's. I remember him saying they had "cost him a pretty penny," but that he never regretted the cost.

2) The man he bought them from told him that the pieces were from a mummy's painted chest decoration. The man also told him that, in life, the person had been a high priest and advisor to the pharaoh.

3) My great uncle had always talked about taking the objects to a museum to have an expert date them, but to my knowledge he never did.

I hope this information is of some help to you. If you have any other questions, please let me know. I will be happy to help if I can.

Sincerely,

[redacted]

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Appendix B: Research Packet (sample page)

Research Notes
Spurlock Museum

Beginning Date: _____ **Report due:** _____
Researcher(s): _____

Note: Every hypothesis must be supported by references from reliable sources. All source information must be recorded in detail (i.e., bibliographic entry and page numbers).

Preliminary Artifact Examination Notes and Questions:

_____

_____

_____

_____

_____

_____

Research Areas:
1)

_____

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_____

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_____

_____

Resources: _____

_____

Appendix C: Exhibit Label Copy

Bound for Eternity

These fragments are thought to be from an ancient Egyptian mummy's painted chest decoration.

Fragments.
Egypt, unknown date. Cloth, plaster, pigment.
Anonymous donor. 1966.3.4-6

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